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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/717,365	11/19/2003	Eric Bass	2069.012700/LE0042	6696
23720 7590 10/05/2007 WILLIAMS, MORGAN & AMERSON 10333 RICHMOND, SUITE 1100 HOUSTON, TX 77042			EXAMINER SINGH, RAMNANDAN P	
			ART UNIT 2614	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	Application No. 10/717,365	Applicant(s) BASS, ERIC	
	Examiner Ramnandan Singh	Art Unit 2614	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 July 2007 & March 26, 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-6 and 8-31 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-6, 8-12 and 21-24 is/are rejected.
- 7) ☒ Claim(s) 13-20 and 25-31 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Election/Restrictions*

1. Applicant's arguments filed on July 19, 2007 with respect to the restriction requirements have been fully considered and are persuasive. The restriction requirements have been withdrawn.

### *Response to Arguments*

2. Applicant's arguments filed on March 26, 2007 have been fully considered but they are not persuasive.

(i) Applicant's argument—"Sues simply does not disclose determining any type of a gain and performing any type of gain adjustment" on pages 15-16.

Examiner's response—Examiner respectfully disagrees. Examiner asserts that the gain adjustment of a signal is basically the amplitude adjustment of the signal. To reinforce this point in a balanced circuit, the Authoritative Dictionary of IEEE standards Terms defines a **balance circuit**: "(measuring longitudinal balance of telephone equipment operating in the voice band) A circuit in which two branches are electrically alike and symmetrical with respect to a common reference point, usually ground."

Further, it elaborates the definition of the balanced circuit for (signal-transmission system): "A circuit in which two branches are electrically alike and symmetrical with respect to a common reference point, usually ground. Note: For an applied signal difference at the input, the signal relative to the reference at equivalent points in the two branches must be opposite in polarity and equal in amplitude" [Page 81-82]. Clearly, the amplitude and phase of a signal are basic criteria for determining whether the circuit is balanced. In this context, Evans et al [US 20020159548 A1] further reinforces the above definition of a balanced circuit in a telephone system [Para: 0055].

(ii) Applicant's argument—"Further, without using improper hindsight reasoning, those skilled in the art would not combine IEEE Std 455-1985 and Sues to make obvious all of the elements of claims 1 of the present invention" on page 16.

Examiner's response--In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon

hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

### ***Claim Objections***

3. Claim 3 is objected to because of the following informalities:

Claim 3 recites the limitation, "The method pf claim 3" in line 1. This is in error. For this Office action Examiner assumes this to be "The method of claim 1".

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
5. Claims 1-6, 8, 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sues et al [US 4,910,768] in view of IEEE Standard Test

Procedures for Measuring Longitudinal Balance [ANSI/IEEE Std 455-1985].

Regarding claim 1, Sues et al teach a method , comprising:

providing a differential signal [Fig. 2; col. 4, line 64 to col. 5, line 2];

and

performing a calibration of a gain (i.e. measurement of **an amplitude** of the differential signal with respect to an amplitude reference) of at least a portion of the differential signal to affect the longitudinal balance associated with the differential signal [Fig. 2; col. 2, lines 32-52],

performing the calibration comprises:

receiving a first portion (i.e. TIP) of the differential signal and determining a gain (i.e. amplitude) associated with the first portion (i.e. TIP) [Figs. 1-2; col. 3, line 36 to col. 4, line 55];

receiving a second portion (i.e. RING) of the differential signal and determining a gain (i.e. amplitude) associated with the second portion (i.e. RING) [Figs. 1-2; col. 3, line 36 to col. 4, line 55];

determining a difference between the respective gains (i.e. amplitudes) of the first (i.e. TIP) and second (i.e. RING) portions to

determine whether the difference is outside a predetermined range of tolerance (i.e. not perfectly balanced) [ Figs. 2-3; col. 4, lines 3-55; col. 4, line 56 to col. 5, line 30; col. 6, lines 3-6]; and

modifying (i.e. adjusting) at least one of the amplitude of the first portion (i.e. TIP) and the amplitude of the second portion (i.e. RING) based upon a determination that the difference is outside the predetermined range of tolerance (i.e. not perfectly balanced) [ Figs. 1-3; col. 4, line 28 to col. 5, line 2; Fig. 3; col. 5, lines 21-46; col. 6, lines 3-6; col. 7, lines 6-47].

Although Sues et al teach an automatic balancing circuit for longitudinal transmission system using balance measurements set [Fig. 2; col. 3, lines 61-67], they do not teach expressly calibration performed by repeating measurements.

IEEE Standard 455-1985 states: "Basically, calibration consists of balancing the internal impedance of the driving test circuit portion of the measurement set against the internal impedances of the terminating test portion" [Appendix B, Page 18]. Further, the standard teaches frogging the interconnections between driving and terminating test circuits, as shown by

broken lines in Fig. B1 [Pages 18-19]. In addition, the Standard defines a balance circuit , wherein the “longitudinal balance” can be expressed in terms of a gain defined by a ratio of two voltages [Page 8].

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the calibration method of the IEEE Standard with Sue et al so that the longitudinal balance calibration of Sue et al is consistent with the Standard.

Claim 9 is essentially similar to claim 1 and is rejected for the reasons stated above.

Claim 10 is essentially similar to claim 1 except for a first and second amplifier. Sue et al teach an apparatus comprising : a first amplifier (40) to receive a first portion of a differential signal (RING) and a second amplifier (39) to receive a second portion of the differential signal to generate a differential output signal using a summing circuit (12) [Figs. 2-3].



Regarding claim 2, Sue et al further teach the method, wherein receiving the signal comprises receiving the telecommunication signal [Fig. 2; col. 5, lines 10-20].

Claim 11 is essentially similar to claim 2 and is rejected for the reasons stated above.

Regarding claim 3, Sue et al further teach the method, wherein receiving the telecommunications signal comprises receiving a TIP and RING signal [Fig. 2; col. 5, lines 10-20].

Claim 12 is essentially similar to claim 3 and is rejected for the reasons stated above.

Regarding claim 4, the limitations are shown above.

Regarding claim 5, Sue et al further teach the method comprising modifying the signal associated with the TIP signal forward and the gain of

a signal associated with the RING signal forward [Fig. 2 ; col. 4, lines 28-65].

Regarding claim 6, IEEE Standard 455-1985 further teaches the method, wherein determining a difference between the respective gains of the first (i.e. TIP) and second (i.e. RING) portions further comprises applying a test load to an output associated with the first portion [Fig. B1; Appendix B; Page 18].

Regarding claim 8, IEEE Standard 455-1985 further teaches the method, wherein applying the test load comprises applying a resistive load [Fig. B1; Appendix B; Page 18].

6. Claims 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sues et al [US 4,910,768] in view of IEEE Standard Test Procedures for Measuring Longitudinal Balance [ANSI/IEEE Std 455-1985], and further in view of Lynch [US 6,724,880 B1].

Regarding claim 21, Sue et al teach a system, as shown in Fig. 2,  
comprising:

a subscriber line [Fig. 2; TIP conductor 31 and RING conductor 32];  
providing a differential signal [Fig. 2; col. 4, line 64 to col. 5, line 2];  
and

performing a calibration of a gain (i.e. measurement of an amplitude  
of the differential signal with respect to an amplitude reference) of at least  
a portion of the differential signal to affect the longitudinal balance  
associated with the differential signal [Figs. 1-2; col. 2, lines 32-52; col. 3,  
line 36 to col. 4, line 55];],

performing the calibration comprises:

receiving a first portion (i.e. TIP) of the differential signal and  
determining a gain associated with the first portion (i.e. TIP) [Figs. 1-2; col.  
3, line 36 to col. 4, line 55];

receiving a second portion (i.e. RING) of the differential signal and  
determining a gain associated with the second portion (i.e. RING) [Figs. 1-  
2; col. 3, line 36 to col. 4, line 55];

; determining a difference between the respective gains of the first  
(i.e. TIP) and second (i.e. RING) portions to determine whether the

difference is outside a predetermined range of tolerance (i.e. not perfectly balanced) [ Figs. 1-2; col. 4, lines 3-55; col. 4, line 66 to col. 5, line 30; col. 6, lines 3-6]; and

modifying (i.e. adjusting) at least one of the gain of the first portion (i.e. TIP) and the gain of the second portion (i.e. RING) based upon a determination that the difference is outside the predetermined range of tolerance (i.e. not perfectly balanced) [ Figs. 1-2; col. 4, line 28 to col. 5, line 2; Fig. 3; col. 5, lines 21-46; col. 6, lines 3-6].

Although Sues et al teach an automatic balancing circuit for longitudinal transmission system using balance measurements set [Fig. 2; col. 3, lines 61-67], they do not teach expressly calibration performed by repeating measurements.

IEEE Standard 455-1985 states: "Basically, calibration consists of balancing the internal impedance of the driving test circuit portion of the measurement set against the internal impedances of the terminating test portion" [Appendix B, Page 18]. Further, the standard teaches frogging the interconnections between driving and terminating test circuits, as shown by

broken lines in Fig. B1 [Pages 18-19]. In addition, the Standard defines a balance circuit , wherein the "longitudinal balance" can be expressed in terms of a gain defined by a ratio of two voltages [Page 8].

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the calibration method of the IEEE Standard with Sue et al so that the longitudinal balance calibration of Sue et al is consistent with the Standard.

Sue et al do not teach expressly using a line card coupling the subscriber line.

Lynch teaches using a line card (140A) coupling the subscriber line, wherein the line card is adapted to provide a differential signal [Figs. 3-4; col. 4, line 57 to col. 5, line 10; col. 5, line 54 to col. 6, line 8; col. 8, lines 43-56].

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the teachings of Lynch with Sue et al

so that a single line card may interface with a substantial number of telecommunications lines, in high density systems [Lynch; col. 2, lines 63-66].

Regarding claim 22, Sue et al further teach an apparatus comprising :  
a first amplifier (40) to receive a first portion of a differential signal (RING)  
and a second amplifier (39) to receive a second portion of the differential  
signal to generate a differential output signal using a summing circuit (12)  
[Figs. 2-3]. The other limitations are shown above.

Regarding claim 23, Sue et al further teach the method, wherein  
receiving the signal comprises receiving the telecommunication signal [Fig.  
2; col. 5, lines 10-20].

Regarding claim 24, Sue et al further teach the method, wherein  
receiving the telecommunications signal comprises receiving a TIP and  
RING signal [Fig. 2; col. 5, lines 10-20].

***Allowable Subject Matter***

8. Claims 13-20 and 25-31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Dependent claim 13 recites the apparatus further comprising, and limitations for the following: "a third amplifier to provide said gain associated with said first portion of said differential output; a fourth amplifier to provide said gain associated with said second portion of said differential output signal; a first current source electrically coupled to said third amplifier and to said calibration unit, said calibration to control said gain associated with said first portion of said differential output signal by controlling said first current source; and a second current source electrically coupled to said fourth amplifier and to said calibration unit, said calibration to control said gain associated with said second portion of said differential output signal by controlling said second current source". The prior art of record does not teach these limitations.

New search updates revealed no other prior art which teaches the limitations in the context of the claims. Therefore, claim 13 is objected to.

Claims 14, 25 and 26 are essentially similar to claim 13, and hence they are also objected to for the reasons stated above. Claims 15-20 being dependent from claim 14 and claims 27-31 being dependent from claim 26 are objected to.

### ***Conclusion***

**9. THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

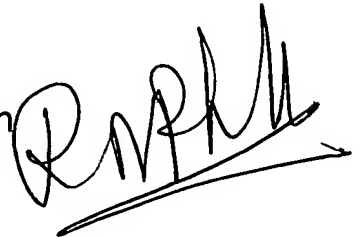


10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ramnandan Singh whose telephone number is (571) 272-7529. The examiner can normally be reached on M-TH (8:00-5:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Fan Tsang can be reached on (571) 272-7547. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Ramnandan Singh  
Primary Examiner  
Art Unit 2614

A handwritten signature in black ink, appearing to read 'Ramnandan Singh', with a long horizontal stroke extending to the right.

**IEEE 100**  
**The Authoritative Dictionary of**  
**IEEE Standards Terms**

**Seventh Edition**



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current-limiting fuse.

(SWG/PE) C37.40-1993  
limiting all currents from the rated  
down to the rated minimum  
(SWG/PE) C37.100-1992  
back up.

A supplementary gap that may  
be level higher than the protective  
device, and that is normally  
primary protective device.

(PE/T&D) 824-1985s  
engineering) A lighting device  
for illuminating the region  
while moving in reverse. It nor-  
mally backs up. (EEC/IE) [126]

device or apparatus (nuclear  
device or apparatus that per-  
forms in the event the primary  
device is out of service.

(PE/NP) 317-1976s  
on path in trunk cabling and  
broken ring signal transmission  
the main ring path.

(C/LM) 8802-5-1998

the assistant leader of a chief  
includes contributing sig-

ing developed by the team,  
reviewing the work of other  
the chief programmer when  
technical understanding of  
also: chief programmer.

(C) 610.12-1990

relay system) A form of  
consistency of specified compo-  
nent. It may duplicate the  
needed to operate only if the  
primarily out of service.

100-1992, C37.90-1978s

relay that is not the pri-  
mary (e.g., zones 2 and  
the backup zone will usu-  
ally be required by the  
protection.

(PE/PSR) C37.113-1999

language used to specify  
in which each symbol,  
symbols. Note: Devel-  
opment of BNF was one of the  
early languages. See also:

10.13-1993w, 771-1989s

metalanguage devel-  
(SCC20) 771-1998

term relating to me-

developed by Backus and  
(SCC20) 771-1998

on regulator in which  
affects the quantity that  
transmission regulator.

(EEC/PE) [119]

ated with the forward  
control signals, but with  
that of the forward

being transferred. Note:

user information in  
with respect to the data

reverse channel.

(C) 610.10-1994w

nonreciprocal wave-  
device used primarily  
tunneling in this

diode results in a current-voltage characteristic in which the  
reverse current is greater than the forward current for equal  
applied voltages of opposite polarity. (MITT) 457-1982w

**backward execution** See: reversible execution.

**backward read** To read data from a sequential storage medium  
in a reverse direction; for example, to read a magnetic tape  
from the end to the beginning. (C) 610.10-1994w

**backward recovery** (1) The reconstruction of a file to a given  
state by reversing all changes made to the file since it was in  
that state. *Contrast:* forward recovery; inline recovery.

(C) 610.5-1990w, 610.12-1990

(2) A type of recovery in which a system program database  
or other system resource is restored to a previous state in  
which it can perform required functions. (C) 610.12-1990

**backward supervision** The use of supervisory sequences from  
a secondary station or node to a primary station or node. *Con-*  
*trast:* forward supervision. (C) 610.7-1995

**backward wave (traveling-wave tubes)** A wave whose group  
velocity is opposite to the direction of electron-stream motion.  
See also: amplifier. (ED) 161-1971w

**backward-wave oscillator** See: carcinotron.

**backward-wave structure (BW) (microwave tubes)** A slow-  
wave structure whose propagation is characterized on an  $\omega/\beta$   
diagram (sometimes called a Brillouin diagram) by a nega-  
tive slope in the region  $0 < \beta < \pi$  (in which the phase  
velocity is therefore of opposite sign to the group velocity).  
(ED) [45]

**back wave** A signal emitted from a radio telegraph transmitter  
during spacing portions of the code characters and between  
the code characters. See also: radio transmission.

(BT) 182A-1964w

**bactericidal effectiveness (illuminating engineering)** The ca-  
pacity of various portions of the ultraviolet spectrum to de-  
stroy bacteria, fungi, and viruses. *Synonym:* germicidal effec-  
tiveness. (EEC/IE) [126]

**bactericidal efficiency of radiant flux (illuminating engineer-  
ing)** The ratio of the bactericidal effectiveness of that wave-  
length to that of wavelength 265.0 nm (nanometers), which  
is rated as unity. (EEC/IE) [126]

**bactericidal exposure (illuminating engineering)** The product  
of bactericidal flux density on a surface and time. It usually  
is measured in bactericidal microwatt-minutes per square cen-  
timeter or bactericidal watt-minutes per square foot. *Syn-*  
*onym:* germicidal exposure. (EEC/IE) [126]

**bactericidal flux (illuminating engineering)** Radiant flux eval-  
uated according to its capacity to produce bactericidal effects.  
It is usually measured in microwatts of ultraviolet radiation  
weighted in accordance with its bactericidal efficiency. Such  
quantities of bactericidal flux would be in bactericidal micro-  
watts. Note: Ultraviolet radiation of wavelength 253.7 nm  
(nanometers) is usually referred to as "ultraviolet microwatts"  
or "UV watts." These terms should not be confused with  
"bactericidal microwatts" because the radiation has not been  
weighted in accordance with the values given in the table  
under erythral flux density. *Synonym:* germicidal flux.

(EEC/IE) [126]

**bactericidal flux density (illuminating engineering)** The bac-  
tericidal flux per unit area of the surface being irradiated. It  
is equal to the quotient of the incident bactericidal flux di-  
vided by the area of the surface when the flux is uniformly  
distributed. It is usually measured in microwatts per square  
centimeter or watts per square foot of bactericidally weighted  
ultraviolet radiation (bactericidal microwatts per square cen-  
timeter or bactericidal watts per square foot). *Synonym:* ger-  
micidal flux density. (EEC/IE) [126]

**badge number** A numeric character code assigned to a badge.  
(PE/NP) 692-1997

**badge reader** A reader capable of reading information on spe-  
cially coded badges or cards. (C) 610.10-1994w

**baffle** (1) (audio and electroacoustics) A shielding structure or  
partition used to increase the effective length of the trans-  
mission path between two points in an acoustic system; as,

for example, between the front and back of an electroacoustic  
transducer. Note: In the case of a loudspeaker, a baffle is often  
used to increase the acoustic loading of the diaphragm.

(SP) [32]

(2) (illuminating engineering) A single opaque or translu-  
cent element to shield a source from direct view at certain  
angles, or to absorb unwanted light. (EEC/IE) [126]

(3) (gas tube) An auxiliary member, placed in the arc path  
and having no separate external connection. Note: A baffle  
may be used for:

- Controlling the flow of mercury vapor or mercury  
particles,
- Controlling the flow of radiant energy,
- Forcing a distribution of current in the arc path,
- Deionizing the mercury vapor following conduction. It  
may be of either conducting or insulating material.

See also: electrode. (ED) [45]

**bag** A kind of collection class whose members are unordered  
but in which duplicates are meaningful. *Contrast:* list; set.

(C/SE) 1320.2-1998

**bag-type construction (dry cell) (primary cell)** A type of con-  
struction in which a layer of paste forms the principal medium  
between the depolarizing mix, contained within a cloth wrap-  
per, and the negative electrode. See also: electrolytic cell.  
(EEC/PE) [119]

**baker board** See: lincperson's platform.

**balance beam** (of a relay) A lever form of relay armature, one  
end of which is actuated upon by one input and the other end  
restrained by a second input.

(SWG/PE/PSR) C37.100-1992, C37.90-1978s

**balance check** In an analog computer, the computer-control  
state in which all amplifier summing junctions are connected  
to the computer zero reference level (usually signal ground)  
to permit zero balance of the operational amplifiers.

(C) 610.10-1994w, 165-1977w

**balanced** (1) (general) Used to signify proper relationship be-  
tween two or more things, such as stereophonic channels.

(2) (data transmission) In communication practice, signifies  
electrically alike and symmetrical with respect to ground, or  
arranged to provide conjugate conductors between certain  
sets of terminals. (PE) 599-1985w

(3) (to ground) The state of impedance on a two-wire circuit  
when the impedance-to-ground of one wire is equal to the  
impedance-to-ground of the other wire. *Contrast:* unbal-  
anced. See also: balun. (C) 610.7-1995

(4) Pertaining to a relationship between two or more objects  
that are alike or symmetrical in some respect. *Contrast:* un-  
balanced. (C) 610.10-1994w

**balanced amplifier (push-pull amplifier)** An amplifier in  
which there are two identical signal branches connected so as  
to operate in phase opposition and with input and output con-  
nections each balanced to ground.

(AP/BT/PE/ANT) 145-1983s, 182-1961w, 599-1985w

**balanced cable** (1) A cable consisting of one or more metallic  
symmetrical cable elements (twisted pairs or quads). local area  
networks. (LM/C) 802.3u-1995s, 8802-12-1998

(2) A cable consisting of one or more metallic symmetrical  
cable elements (twisted pairs or quads).

**balanced capacitance** (between two conductors) (mutual ca-  
pacitance between two conductors) The capacitance between  
two conductors when the changes in the charges on the two  
are equal in magnitude but opposite in sign and the potentials  
of the other  $n - 2$  conductors are held constant. See also:  
direct capacitances. (IM/HFIM) [40]

**balanced circuit** (1) (measuring longitudinal balance of tele-  
phone equipment operating in the voice band) A circuit in  
which two branches are electrically alike and symmetrical  
with respect to a common reference point, usually ground.

(COM/TA) 455-1985w

(2) (signal-transmission system) A circuit, in which two  
branches are electrically alike and symmetrical with respect  
to a common reference point, usually ground. Note: For an

applied signal difference at the input, the signal relative to the reference at equivalent points in the two branches must be opposite in polarity and equal in amplitude.

(IM/HFIM) [40]

(3) (electric power system) A circuit in which there are substantially equal currents, either alternating or direct, in all main wires and substantially equal voltages between main wires and between each main wire and neutral (if one exists). *See also*: center of distribution.

(T&D/PE) [10]

**balanced conditions (1) (rotating machinery) (time domain)** A set of polyphase quantities (phase currents, phase voltages, etc.) that are sinusoidal in time, that have identical amplitudes, and that are shifted in time with respect to each other by identical phase angles.

(2) (space domain) In space, a set of coils (for example, of a rotating machine) each having the same number of effective turns, with their magnetic axes shifted by identical angular displacements with respect to each other. *Notes*: 1. The impedance (matrix) of a balanced machine is balanced. A balanced set of currents will produce a balanced set of voltage drops across a balanced set of impedances. 2. If all sets of windings of a machine are balanced and if the magnetic structure is balanced, the machine is balanced. *See also*: asynchronous machine.

(PE) [9]

**balanced currents (waveguide) (on a balanced line)** Currents flowing in the two conductors of a balanced line, which, at every point along the line, are equal in magnitude and opposite in direction.

(MTT) 146-1980w

**balanced duplexer (radar) (nonlinear, active, and nonreciprocal waveguide components)** A dualized network using two quadrature hybrids on each side of a pair of self-switching elements used to interconnect the transmitter, receiver, and antenna in a radar. *See also*: duplexer.

(MTT) 457-1982w

**balanced error (A)** A set of error values in which the maximum and minimum are opposite in sign and equal in magnitude. *Contrast*: unbalanced error. **(B)** A set of error values whose average is zero. *Contrast*: unbalanced error.

(C) 1084-1986

**balanced line (waveguide) (two conductor)** A transmission line consisting of two conductors in the presence of ground capable of being operated in such a way that the voltages on the two conductors at all transverse planes are equal in magnitude and opposite in direction. The ground may be a conducting sheath, forming a shielded transmission line.

(MTT) 146-1980w

**balanced line system (waveguide)** A system consisting of a generator and a balanced line, and load-adjusted so that the voltages of the two conductors at all transverse planes are equal in magnitude and opposite in polarity with respect to ground.

(MTT) 146-1980w

**balanced merge** A merge in which the subsets to be merged are equally distributed among half of the available storage, then the subsets are merged onto the other half of storage. *Contrast*: unbalanced merge.

(C) 610.5-1990w

**balanced merge sort** A merge sort in which the sorted subsets created by internal sorts are equally distributed among half of the available storage, the subsets are merged onto the other half of the available storage, and this process is repeated until all the items are in one sorted set. *Contrast*: unbalanced merge sort.

(C) 610.5-1990w

**balanced mixer (1) (single, double)** A type of mixer that forms from two signals A & B a third signal C having the form  $C = (a+A)(b+B)$ . "Single balanced" implies  $a = 0$ ,  $b \neq 0$ ; "double balanced" implies  $a = b = 0$ . *Note*: Such mixers can suppress a RF carrier and/or a local oscillator in their output spectrum. *Synonym*: balanced modulator.

(CAS) [13]

(2) A hybrid junction with crystal receivers in one pair of uncoupled arms the arms of the remaining pair being fed from a signal source and a local oscillator. *Note*: The resulting intermediate-frequency signals from the crystals are added in such a manner that the effect of local-oscillator noise is min-

imized. *See also*: radio receiver; hybrid junction; converter; waveguide.

(AP/ANT) [35], [84]

**balanced modulator (signal-transmission system)** A modulator, specifically a push-pull circuit, in which the carrier and modulating signal are so introduced that after modulation takes place the output contains the two sidebands without the carrier. *See also*: modulation.

(AP/ANT) 145-1983s

**balanced oscillator** An oscillator in which, at the oscillator frequency, the impedance centers of the tank circuit are at ground potential and the voltages between either end and their centers are equal in magnitude and opposite in phase. *See also*: oscillatory circuit.

(AP/BT/ANT) 145-1983s, 182A-1964w

**balanced polyphase load** A load to which symmetrical currents are supplied when it is connected to a system having symmetrical voltages. *Note*: The term "balanced polyphase load" is applied also to a load to which two currents having the same wave form and root-mean-square value and differing in phase by 90 electrical degrees are supplied when it is connected to a quarter-phase (or two-phase) system having voltages of the same wave form and root-mean-square value. *See also*: generating station.

(T&D/PE) [10]

**balanced polyphase system** A polyphase system in which both the currents and voltages are symmetrical. *See also*: alternating-current distribution.

(T&D/PE) [10]

**balanced relay armature** An armature that is approximately in equilibrium with respect to both static and dynamic forces.

(EEC/REE) [87]

**balanced telephone-influence factor (three-phase synchronous machine)** The ratio of the square root of the sum of the squares of the weighted root-mean-square values of the fundamental and the nontriple series of harmonics to the root-mean-square value of the normal no-load voltage wave.

(PE) [9]

**balanced termination (system or network having two output terminals)** A load presenting the same impedance to ground for each of the output terminals. *See also*: network analysis.

(MTT) 146-1980w

**balanced three-wire system** A three-wire system in which no current flows in the conductor connected to the neutral point of the supply. *See also*: three-wire system; alternating-current distribution.

(T&D/PE) [10]

**balanced tree** *See*: height-balanced tree.

**balanced voltages (1) (waveguide) (on a balanced line)** Voltages relative to ground on the two conductors of a balanced line which, at every point along the line, are equal in magnitude and opposite in polarity.

(MTT) 146-1980w

(2) (signal-transmission system) The voltages between corresponding points of a balanced circuit (voltages at a transverse plane) and the reference plane relative to which the circuit is balanced. *See also*: signal.

(IE) [43]

**balanced wire circuit (data transmission)** One whose two sides are electrically alike and symmetrical with respect to ground and other conductors. The term is commonly used to indicate a circuit whose two sides differ only by chance.

(PE) 599-1985w

**balancer** That portion of a direction-finder that is used for the purpose of improving the sharpness of the direction indication. *See also*: radio receiver.

(EEC/PE) [119]

**balance relay** A relay that operates by comparing the magnitudes of two similar input quantities. *Note*: The balance may be effected by counteracting electromagnetic forces on a common armature, or by counteracting magnetomotive forces in a common magnetic circuit, or by similar means, such as springs, levers, etc.

(SWG/PE) C37.100-1992

**balance test (rotating machinery)** A test taken to enable a rotor to be balanced within specified limits. *See also*: rotor.

(PE) [9]

**balancing (1)** Adjusting the gains and losses in each path of a system to achieve proper cable plant characteristics.

(LM/C) 802.7-1989r